



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 16 1985

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Dermal Exposure to Fragrance in Bar Soap
FROM: Elizabeth F. Bryan *Liz*
Exposure Assessment Branch (TS-798)
TO: PMN Assessors

Although fragrances may be used in a variety of consumer products, our PMN assessments have focused on the use of bar soap to calculate possible dermal exposures because the use of bar soap is expected to result in the highest exposure levels via that route. We recently made some modifications to this scenario, and this new version (attached) should be used by all assessors in preparing EXAM Reports and Standard Reviews for fragrance compounds unless information in the PMN clearly indicates that such a use is highly unlikely.

Versar, under the direction of Robin Anderson, currently is gathering additional data that may impact some of the assumptions that we use in this assessment; I'll keep you informed of any such data as they become available.

PMN Assessors

Anderson	Hall	Lynch	Schweer
Boethling	Hammerstrom	Mamantov	Thom
Delpire	Harrigan	Mauriello	
Frederick	Kennedy	Nold	

cc: Carra
Callahan
Kinerson
Wood

Dermal Exposure to Fragrance in Bar Soap

$$\text{Annual exposure (Z)} = W + B$$

(Equation 1)

where W = annual exposure from washing hands
B = annual exposure from bathing

W and B are calculated as follows

$$W = P \times S \times D \times T \times F \times S_w \times E_w$$

$$B = P \times S \times D \times T \times F \times S_b \times E_b$$

Substituting these values into Equation 1 and rearranging gives

$$Z = P \times S \times D \times T \times F (S_w \times E_w + S_b \times E_b) \quad (\text{Equation 2})$$

where P = concentration of PMN in fragrance formulation
(If not identified in PMN, use 3 wt%; if identified in PMN, use highest value.)

S = concentration of fragrance formulation in bar soap
(Use 3 wt% - Ref. 1)

D = density of soap/water solution
(Use 940mg/cm³ - Ref. 2, assuming density of a soap/water solution is approximately that of a 50/50 wt% bath oil/water solution.)

T = thickness of soap film on skin
(Use 0.01cm - Ref. 2, assuming thickness of a soap/water film is similar to that for a bath oil/water film.)

F = dilution factor for soap in water
(Use 0.001 - based on monthly consumption of soap and amount of water used to form lather; see Robin Anderson for additional details.)

S_w = surface area of two, adult male hands
(Use 810cm² - Ref. 3)

S_b = surface area of average adult male
(Use 18,000cm² - Ref. 3)

E_w = number of times hands are washed per year
(Use 1,825 - 5 times per day)

E_b = number of baths per year
(Use 365)

Substituting the assumed values into Equation 2 and solving for Z (annual dermal exposure) gives

$$Z = (0.03 \times 0.03 \times 940\text{mg/cm}^3 \times 0.01\text{cm} \times 0.001) (810\text{cm}^2 \times 1825/\text{Yr} + 18000\text{cm}^2 \times 365/\text{Yr})$$

$$Z = 70\text{mg/Yr (or 1mg/Kg/Yr)}$$

Daily exposure would be 0.2mg/day (or 3ug/kg/day)

References

1. Gosselin. 1984. Computerized version of Clinical Toxicity of Commercial Products. 5th edition. Baltimore, MD. Williams and Wilkins Co.
2. Versar, Inc. 1984. Exposure Assessment for Retention of Chemical Liquids on Hands. Draft Final Report. Washington, DC. USEPA Contract No. 68-01-6271, Task No. 56.
3. Versar, Inc. 1984. Methods for Assessing Exposure to Chemical Substances: Vol. 7. Draft Report. Washington, DC. USEPA Contract No. 68-01-6271, Task No. 63.

3.8 x 10⁻²
7.4 x 10⁻²